इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 7670 (2002): Aluminium Alloy Forging Stock and Forgings (for Parts Operated at Elevated Temperatures) for Aircraft Purposes (Alloy 22588) [MTD 7: Light Metals and their Alloys]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN
IGNORANTIA JURIS NON EXCUSAT
PROTECTED BY COPYRIGHT

भारतीय मानक

वायु आकाशीय अनुप्रयोगों हेतु एल्युमीनियम धातुओं से बनी फोर्जिंग स्टाक एवं फोर्जिंग (उत्थापित तापमानों में प्रचालित घटकों के लिए) (मिश्र धातु 22588) — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

ALUMINIUM ALLOY FORGING STOCK AND FORGINGS (FOR PARTS OPERATED AT ELEVATED TEMPERATURES) FOR AEROSPACE APPLICATIONS (ALLOY 22588) — SPECIFICATION

(First Revision)

ICS 49.025.15 : 77.120.10

© BIS 2002

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

August 2002 **Price Group 3**

Light Metals and Their Alloys Sectional Committee, MTD 7

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Light Metals and Their Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1975. While reviewing this standard in the light of experience gained during these years, the Sectional Committee decided to revise the standard.

Aluminium alloy forgings are widely used for components operated at elevated temperatures in aircrafts and aero-engines. Need was, therefore, felt to lay down requirements for forging stock (bars, rods or sections/ billets) as well as forgings.

In this revision, the alloy composition and mechanical properties have been rationalized and brought at par with the following International Aerospace Specifications, while keeping in view indigenous manufacturing practices:

DTD 717 A	Forgings stock and forgings of aluminium-copper-magnesium-nicked-iron alloy (Solution treated and precipitation treated at 170°C), Ministry of Defence.
DTD 731 B	Forgings stock and forgings of aluminium-copper-magnesium-nickel-iron alloy (Solution treated and precipitation treated at 200°C), Ministry of Defence.
DTD 745 A	Forgings stock and compressor blade forgings of aluminium-copper-magnesium-nickel-iron alloy. Ministry of Defence, UK
DTD 5084 A	Forgings stock and forgings of aluminium-copper-magnesium-nickel-iron alloy (Solution treated and precipitation treated, special heat treatment for minimum residual internal stress), Ministry of Defence, UK.
GOST 4784-1974	Wrought aluminium alloys — Grades — Grade AK$_1$.Gosudorstvenny Komitet Standartov, Mer i Izmeritelinyl Priborov (SSSR) (USSR).
QQ-A-367H	Aluminium alloy forgings (Alloy 2618), Federal Specification, USA.
AIR 9051A	General acceptance requirements of semi-finished products in aluminium alloys for forgings AFNOR A-U2GN (2618A) Ministry of Defence, France

The composition of the Committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ALUMINIUM ALLOY FORGING STOCK AND FORGINGS (FOR PARTS OPERATED AT ELEVATED TEMPERATURES) FOR AEROSPACE APPLICATIONS (ALLOY 22588) — SPECIFICATION

(First Revision)

1 SCOPE

This standard covers the requirements of aluminium-copper-magnesium-nickel-iron alloy (Alloy 22588) forging stocks (billets, bars, rods, sections) and forgings. The material is intended for parts operating at elevated temperatures.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
23 : 1980	Primary aluminium and ingots for remelting for aircraft purposes (*third revision*)
504 : 1963	Methods of chemical analysis of aluminium and its alloys (*revised*)
1500 : 1983	Method for Brinell hardness test for metallic materials (*second revision*)
1608 : 1995	Mechanical testing of metals — Tensile testing (*second revision*)
3658 : 1999	Code of practice for liquid penetrant flaw detection (*second revision*)
3664 : 1981	Code of practice for ultrasonic pulse echo testing by contact and immersion methods (*first revision*)
5047(Part 1) : 1986	Glossary of terms relating to aluminium and aluminium alloys: Part 1 Unwrought and wrought metals (*second revision*)
7674 : 1975	Procedure for inspection and testing of aluminium and aluminium alloy forging stock and forgings for aircraft purposes
10259 : 1982	General condition of delivery and inspection of aluminium and aluminium alloy products

3 TERMINOLOGY

3.1 For the purpose of this standard the definition of terms as given in IS 5047 (Part 1), IS 7674 and the following shall apply.

3.1.1 *Approved Scrap*

The scrap which is derived from manufacturer's own production from approved material, ingots and castings etc, where in the material composition has been established with regard to both alloying elements and impurities to the relevant specification segregated and identified to the satisfaction of inspecting authority.

3.1.2 *Cast (Melt)*

A cast is defined as:

a) the product of one furnace or crucible melt,
b) the product of number of furnace/crucible melts timely mixed prior to casting and analyzed, and
c) the amount of metal tapped from furnace without any further additions made, when continuous melting process is employed.

3.1.3 *Extrusion Billet*

A solid or hollow cast billet for extrusion to solid or hollow shapes and sections.

3.1.4 *Harmful Defects*

Any defect prejudicial to subsequent manufacture, fabrication or use of material (*see also* IS 7674 for details).

4 SUPPLY OF MATERIAL

General requirements relating to the supply of material shall conform to IS 10259.

5 MANUFACTURE

Only virgin material or approved scrap shall be used for manufacture of the alloy and shall comply to the requirements of IS 23.

6 FREEDOM FROM DEFECTS

Forging stock and forgings shall be of uniform quality, sound and free from harmful defects.

7 GRADES

The material shall be supplied in 2 Grades such as 22588A and 22588B based on heat treatment cycles as given in Table 2 and Table 3

8 CHEMICAL COMPOSITION

The material when analyzed as per IS 504 or any other established instrumental/chemical method shall conform to the requirements as given in Table 1. In case of dispute, the procedure given in IS 504 shall be the referee method. However when the method is not given in IS 504 the referee method shall be as agreed to between the purchaser and the manufacturer.

Table 1 Chemical Composition

Element	Percent	
	Min	*Max*
(1)	(2)	(3)
Copper	1.8	2.7
Magnesium	1.2	1.8
Nickel	0.8	1.4
Iron	0.9	1.4
Silicon	—	0.25
Titanium+Zirconium	—	0.25
Manganese[1]	—	0.2
Zinc[1]	—	0.15
Tin[1]	—	0.05
Lead[1]	—	0.05
Aluminium	◄—— Remainder ——►	

[1] These elements may be determined only on a small portion of the samples analyzed, subject to the discretion of the inspecting authority.

9 CONDITION OF SUPPLY

9.1 Forging Stocks

The forging stocks shall be straightened and supplied in the as manufactured condition (M).

9.2 Forgings

The forgings shall be supplied in solution treated and precipitation treated condition (WP).

10 HEAT TREATMENT

The heat treatment cycles for forgings shall be followed as given in Table 2.

11 MECHANICAL PROPERTIES

11.1 Tensile Test

11.1.1 The heat treated forged bar/forgings when tested in accordance with IS 1608, shall conform to the values given in Table 3.

Table 2 Heat Treatment Cycles

(*Clauses* 7 *and* 10)

		22588A	22588B
		(1)	(2)
Solution Treatment	Temperature:	530 ± 5°C	530 ± 5°C
	Time:	6-10 h	1-24 h
	Quenching Media:	Boiling water	Boiling water[1]
Precipitation Treatment	Temperature:	170 ± 10°C	200 ± 10°C
	Time:	16-24 h	20-24 h

NOTE — Soaking time to be 1 h per 25 mm of thickness, however maximum soaking time to be within specified period.

[1] If agreed by the purchaser, in a suitable oil at room temperature.

11.1.2 The test specimen prepared in accordance with relevant clauses of IS 7674, shall be taken in the longitudinal direction or along the grain.

Table 3 Mechanical Properties

(*Clauses* 7 *and* 11.1.1)

Grade	0.2% Proof Stress, MPa	Tensile Strength, MPa	% Elongation on $5.65\sqrt{S_o}$
	Min	*Min*	*Min*
(1)	(2)	(3)	(4)
22588A	260	400	11
22588B	340	430	5

11.2 Hardness

11.2.1 The Brinell hardness test shall be carried out as per IS 1500 on forgings and forged test pieces (using $P/D^2 = 10$).

11.2.2 The hardness of forgings and forging test pieces, heat treated as per **10** shall not be less than 125 HB.

12 DIMENSIONS AND TOLERANCES

The tolerance on the dimensions of the forging stock and forgings shall conform to the requirements of IS 7674.

13 QUALITY ASSURANCE

13.1 Inspection and Testing

13.1.1 The purchaser shall be given full opportunity to inspect/test the material at any time/stage of manufacture.

13.1.2 The forging stock and forgings shall be inspected and tested as per the requirements given in IS 7674.

13.1.3 The manufacturer shall supply a copy of the chemical analysis report of the alloy.

13.2 Special Tests

13.2.1 *Ultrasonic and Dye Penetrant Tests*

Ultrasonic test as per IS 3664 and dye penetrant test as per IS 3658 shall be carried out on the forging stock and forgings, to ensure that the material is free from harmful defects.

13.2.2 *Macro and Micro Examination*

Macro and micro examination shall be carried on the samples selected. Grain flow pattern on macro etched sections of the forgings shall conform to those indicated on the drawing/test sheet/related documents. The micro examination shall reveal satisfactory structure, free from inclusions and heterogeneity etc.

14 RETEST

14.1 In case of failure of the material in any test, acceptance/rejection shall be based on the results of retest conducted as per IS 7674.

14.2 Any material can be rejected for faults in manufacture although it may have passed chemical and mechanical tests.

14.3 Forging stock and forgings shall conform to dimensions and tolerances, chemical composition, mechanical properties and hardness requirements. Forging stock and forgings not meeting the requirement shall be rejected.

15 PACKING

The forging stock and forgings shall be packed in such a manner so as to prevent damage in ordinary handling and transportation. The type of packing and gross weight of individual package shall be left to the discretion of the supplier. Each package shall contain only one size, alloy or temper material when packed for dispatch.

16 MARKING

16.1 Each package shall be marked with the details as given in IS 7674.

16.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

16.2.1 The use of the Standard Mark is governed by the provision of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made there under. The details of the conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Light Metals and Their Alloys Sectional Committee, MTD 7

Organization	*Representative (s)*
In personal capacity (*Flat No. 102, Rohtas Court, 15 Gokhale Marg, Lucknow-226001*)	Shri V. K. Agrawal (***Chairman***)
Aeronautical Development Establishment, Bangalore	Shri N. C. Sud Shrimati Chhaya Rajput (*Alternate*)
Aluminium Association of India, Bangalore	Prof K. S. S Murthy Shri K. S. Nagesh (*Alternate*)
Bharat Aluminium Co Ltd, Korba/New Delhi	Shri D. K. Biswas Shri S. M. Chobey (*Alternate* I) Shri V. K. Vasudeva (*Alternate* II)
Bharat Forge Ltd, Pune	Shri N. R. Habbu Shri A. R. Chauthai (*Alternate*)
Bharat Heavy Electricals Ltd, Bhopal/Hyderabad	Shri R. K. Seth Shri C. Kannan (*Alternate*)
CEMILAC , Ministry of Defence, Bangalore	Dr P. Raghothama Rao
Central Electricity Authority, New Delhi	Shri Karnail Singh Shri Narender Singh (*Alternate*)
Central Electrochemical Research Institute, Karaikudi	Shri A. Selvakesavan Dr V. Ananth (*Alternate*)
Central Power Research Institute, Bangalore	Dr Seetharamu Shri B. H. Narayana (*Alternate*)
Civil Aviation Departmment, Bangalore/New Delhi	Shri R. C. Gupta Shri M. M. Walecha (*Alternate*)
DGS&D (Inspection Wing), New Delhi/Bhilai	Shri B. B. Rai Shri S. K. Pandey (*Alternate*)
Defence Research & Development Laboratory, Hyderabad	Dr S. Sundarajan Shri G. Raja Singh (*Alternate*)
Development Commissioner (SSI), New Delhi	Director (Met)
Electrical Manufacturing Co Ltd, Kolkata	Shri G. K. Ghosh
Galada Continuous Castings Ltd, Hyderabad	Shri D. C. Galada
Heat Treaters and Engineers, Mumbai	Shri Sandeep Parikh
Hindalco Industsries Ltd, Renukoot	Shri J. P. Singh Shri Abhay Agarwal (*Alternate*)
Hindustan Aeronautics Ltd, Bangalore	Dr P. K. Sengupta Shri D. Dutta (*Alternate*)
ISRO (VSSC), Thiruvananthapuram	Dr P. K. Balasubramaniam
India Foils Ltd, Kolkata	Representative
India Pistons Ltd, Chennai	Shri N. Gowrishankar Shri S. Sundarajan (*Alternate*)
Indian Aluminium Co Ltd, Taloja/Kolkata	Shri S. V. Desai Shri S. Gupta (*Alternate*)
Indira Gandhi Centre for Atomic Research, Kalpakkam	Shri K. V. Kasiviswanathan
Institute of Indian Foundrymen, New Delhi	Shri Udayan Sen
J.L.N. Aluminium R&D and Design Centre, Nagpur	Dr V. V. Kutumbarao
Jindal Aluminium Ltd, Bangalore	Shri K. R. Raghunath Shri S. C. Agrawal (*Alternate*)
Ministry of Defence (DGAQA), Hyderabad	Shri K. N. Sinha Shri V. K. Sachdeva (*Alternate*)

(*Continued on page 5*)

(*Continued from page* 4)

Organization	*Representative (s)*
Ministry of Defence (DGQA), Ichapur	SHRI A. BHATTACHARYA SHRI P. K. L. R. NIMONKAR (*Alternate*)
Ministry of Defence (DMRL), Hyderabad	DR AMOL A. GOKHALE SHRI VIJAY SINGH (*Alternate*)
Ministry of Defence (OFB), Ambernath	DR S. K. PANDEY SHRI P. R. JADAV (*Alternate*)
National Aerospace Laboratory, Bangalore	DR R. V. KRISHNAN
National Aluminium Co Ltd, Bhubaneswar	SHRI M. M. SETH SHRI S. P. MOHAPATARA (*Alternate*)
National Metallurgical Laboratory, Jamshedpur	SHRI KISHORI LAL
National Thermal Power Corporation, Noida	REPRESENTATIVE
RDSO, Lucknow	DIRECTOR (M&C-I) DIRECTOR (CARRIAGE)/I&L (*Alternate* I) ARO (MET-V) (*Alternate* II)
Rural Electrification Corporation, New Delhi	REPRESENTATIVE
BIS Directorate General	SHRI JAGMOHAN SINGH, Director & Head (MTD) [Representing Director General (*Ex-officio*)]

Member-Secretary
SHRI DEEPAK JAIN
Joint Director (MTD), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. MTD 7 (4063)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices : Telephone

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110 002
323 76 17
323 38 41

Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi
KOLKATA 700 054
337 84 99, 337 85 61
337 86 26, 337 91 20

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022
60 38 43
60 20 25

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600 113
254 12 16, 254 14 42
254 25 19, 254 13 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400 093
832 92 95, 832 78 58
832 78 91, 832 78 92

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM

Reprography Unit, BIS, New Delhi, India